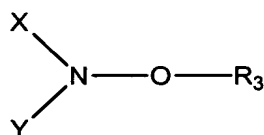


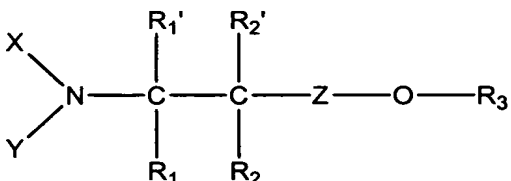
## CLAIMS

WHAT IS CLAIMED IS:

1. An aqueous semiconductor cleaning solution comprising:  
at least about 75% by weight water;  
from about 0.5% to about 10% by weight phosphoric acid;  
at least one alkaline compound selected from the group consisting of: a quaternary ammonium hydroxide; a hydroxylamine derivative having the structural formula:



wherein  $\text{R}_3$  is hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms; and wherein X and Y are, independently, hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms, or wherein X and Y are linked together form a nitrogen-containing heterocyclic  $\text{C}_4$ - $\text{C}_7$  ring; and a mixture thereof; and optionally one or more other acid compounds, one or more fluoride-containing compounds, and/or one or more alkanolamines having the structural formula:



wherein  $\text{R}_1$ ,  $\text{R}_1'$ ,  $\text{R}_2$ ,  $\text{R}_2'$ , and  $\text{R}_3$  are, independently in each case, hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms; wherein Z is a group having the formula  $(-\text{Q}-\text{CR}_1\text{R}_1'-\text{CR}_2\text{R}_2'-)_m$ , such that m is a whole number from 0 to 3 (*i.e.*, when  $m=0$ , there is no atom between the  $-\text{CR}_2\text{R}_2'$  group and the  $-\text{OR}_3$  group in the formula above),  $\text{R}_1$ ,  $\text{R}_1'$ ,  $\text{R}_2$ , and  $\text{R}_2'$  may be independently defined in each repeat unit, if  $m>1$ , within the parameters set forth for these moieties above, and Q may be independently defined in each repeat unit, if  $m>1$ , each Q being independently either -O- or  $-\text{NR}_3$ -; and wherein X and Y are, independently in each case, hydrogen, a  $\text{C}_1$ - $\text{C}_7$  linear, branched, or cyclic hydrocarbon, or a group having the formula  $-\text{CR}_1\text{R}_1'-\text{CR}_2\text{R}_2'-\text{Z}-\text{F}$ , with F being either  $-\text{OR}_3$  or  $-\text{NR}_3\text{R}_4$ , where  $\text{R}_4$  is defined similarly to  $\text{R}_1$ ,  $\text{R}_1'$ ,  $\text{R}_2$ ,  $\text{R}_2'$ , and  $\text{R}_3$  above, and with Z,  $\text{R}_1$ ,  $\text{R}_1'$ ,  $\text{R}_2$ ,  $\text{R}_2'$ , and  $\text{R}_3$  defined as above, or wherein X and Y are linked together form a nitrogen-containing heterocyclic  $\text{C}_4$ - $\text{C}_7$  ring.

- 1 2. The aqueous semiconductor cleaning solution of claim 1, wherein the pH of the  
2 solution is between about 2 and about 6.
- 1 3. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one  
2 alkaline component comprises a hydroxylamine derivative present in an amount from about  
3 0.3% to about 1% by weight.
- 1 4. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one  
2 alkaline component comprises hydroxylamine or N,N-diethylhydroxylamine.
- 1 5. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one  
2 alkaline component comprises a quaternary ammonium compound present in an amount  
3 from about 0.5% to about 3% by weight.
- 1 6. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one  
2 alkaline component comprises choline hydroxide.
- 1 7. The aqueous semiconductor cleaning solution of claim 1, which comprises one or  
2 more other acid compounds selected from the group consisting of hydrochloric acid, nitric  
3 acid, periodic acid, pyrophosphoric acid, fluorosilicic acid, sulfuric acid, methanesulfonic  
4 acid, oxalic acid, lactic acid, citric acid, xylenesulfonic acid, toluenesulfonic acid, formic  
5 acid, tartaric acid, propionic acid, benzoic acid, ascorbic acid, gluconic acid, malic acid,  
6 malonic acid, succinic acid, gallic acid, butyric acid, trifluoroacetic acid, and mixtures  
7 thereof.
- 1 8. The aqueous semiconductor cleaning solution of claim 7, wherein the one or more  
2 other acid compounds is glycolic acid, methanesulfonic acid, pyrophosphoric acid, oxalic  
3 acid, lactic acid, or citric acid.
- 1 9. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more  
2 other acids are present in an amount from about 0.2% to about 5% by weight.
- 1 10. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more  
2 fluorine-containing compounds are present in an amount from about 0.01% to about 0.1%  
3 by weight.

- 1 11. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more  
2 fluorine-containing compounds comprise ammonium bifluoride and/or ammonium fluoride.
- 1 12. The aqueous semiconductor cleaning solution of claim 1, further comprising an  
2 organic solvent in an amount from about 5% to about 15% by weight.
- 1 13. The aqueous semiconductor cleaning solution of claim 1, wherein the organic  
2 solvent comprises an organic acid ester.
- 1 14. The aqueous semiconductor cleaning solution of claim 1, further comprising a  
2 surfactant.
- 1 15. The aqueous semiconductor cleaning solution of claim 1, further comprising one or  
2 more alkanolamines selected from the group consisting of monoethanolamine, 2-(2-  
3 hydroxyethylamino)ethanol, 2-(2-aminoethoxy)ethanol, N,N,N-tris(2-hydroxyethyl)-  
4 ammonia, isopropanolamine, 3-amino-1-propanol, 2-amino-1-propanol,  
5 2-(N-methylamino)ethanol, 2-(2-aminoethylamino)ethanol, and mixtures thereof.
- 1 16. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more  
2 alkanolamines is present in an amount from about 0.5% to about 5% by weight.
- 1 17. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is  
2 substantially free from other acid compounds.
- 1 18. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is  
2 substantially free from fluoride-containing compounds.
- 1 19. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is  
2 substantially free from alkanolamines.
- 1 20. The aqueous semiconductor cleaning solution of claim 1, wherein the solution  
2 contains substantially no additional components.
- 1 21. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is  
2 substantially free from hydroxylamine derivatives.

- 1 22. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is  
2 substantially free from organic solvents.
- 1 23. The aqueous semiconductor cleaning solution of claim 1, wherein the concentration  
2 of water is at least about 85% by weight.
- 1 24. A dilute aqueous cleaner and residue remover comprising:  
2 water, optionally in a mixture with one or more polar organic solvents, wherein the  
3 water is present at least about 75% by weight;  
4 phosphoric acid or salt thereof, present in an amount from about 0.1% to about 6%  
5 by weight of 85% phosphoric acid;  
6 optionally, a quaternary ammonium compound, present in the solution in an amount  
7 from about 0.2% to about 5% by weight;  
8 optionally, a hydroxylamine derivative, present in the solution in an amount from  
9 about 0.1% to about 5% by weight not including the counterion of the hydroxylamine  
10 derivative salt, if present;  
11 optionally, an alkanolamine, present in the solution in an amount from about 0.2%  
12 to about 5% by weight;  
13 optionally, a fluoride-containing compound, present in the solution in an amount  
14 from about 0.001% to about 0.5% by weight;  
15 optionally, an other acid compound, present in the solution in an amount from about  
16 0.05% to about 6% by weight;  
17 optionally, a chelating agent, present in the solution in an amount from about 0.1%  
18 to about 8% by weight;  
19 optionally, a surfactant, present in the solution in an amount from about 0.01% to  
20 about 3% by weight.
- 1 25. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%  
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a  
3 hydroxylamine derivative, preferably hydroxylamine; and about 0.005% to about 0.04% by  
4 weight of a fluoride-containing compound, preferably ammonium bifluoride.
- 1 26. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%  
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a

3 hydroxylamine derivative; about 0.005% to about 0.04% by weight of a fluoride-containing  
4 compound; and about 0.05% to about 0.2% by weight of a surfactant.

1 27. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%  
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a  
3 hydroxylamine derivative, preferably hydroxylamine; and about 0.005% to about 0.1% by  
4 weight of a fluoride-containing compound, preferably ammonium fluoride.

1 28. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%  
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a  
3 hydroxylamine derivative; about 0.005% to about 0.1% by weight of a fluoride-containing  
4 compound; and about 5% to about 15% by weight of a polar organic solvent.

1 29. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%  
2 to about 2.5% by weight of phosphoric acid; and about 0.5% to about 1.5% by weight of a  
3 quaternary ammonium salt.

1 30. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%  
2 to about 4% by weight of 85% phosphoric acid; about 0.3% to about 4% by weight of  
3 oxalic acid dihydrate; about 0.3% to about 4% by weight of a monofunctional organic acid;  
4 about 90% to about 99% by weight of water; and optionally between about 0.1% and about  
5 1% of a chelator, wherein the formulation contains substantially no organic solvents and  
6 SARA 3 hazardous compounds.

1 31. A dilute aqueous cleaner and residue remover consisting essentially of: optionally  
2 about 0.5% to about 6% by weight of 85% phosphoric acid; about 2% to about 12% by  
3 weight of oxalic acid dihydrate; optionally about 0.2% to about 15% by weight of a  
4 monofunctional organic acid; optionally between about 0.05% and 1.5% by weight of  
5 ammonium hydroxide, an alkyl ammonium hydroxide substituted with 2 or 3 alkyl moieties  
6 independently selected from methyl and ethyl moieties, or a mixture thereof; optionally  
7 between about 0.1% and about 1% of a chelator; and water wherein the formulation  
8 contains substantially no organic solvents and SARA 3 hazardous compounds.